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ABSTRACT

This document is a curriculum guide for a 180-hour course in advanced electronics for 11th and 12th grades that has four instructional units. The instructional units are orientation, discrete components, integrated circuits, and electronic systems. The document includes a course flow chart; a two-page section that describes the course, lists target grade levels, course goals and objectives, and introduces the course; a time frame; a course outline; tabular material that provides for each unit objectives, topics, student activities, teacher activities, resources, and time estimates; and an 18-item bibliography. (CML)

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ADVANCED ELECTRONICS

1986
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Bulletin 1778

CURRICULUM DEVELOPMENT

LOUISIANA DEPARTMENT OF EDUCATION

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ADVANCED ELECTRONICS

BULLETIN 1778

Dr. Thomas Eppler
Project Director

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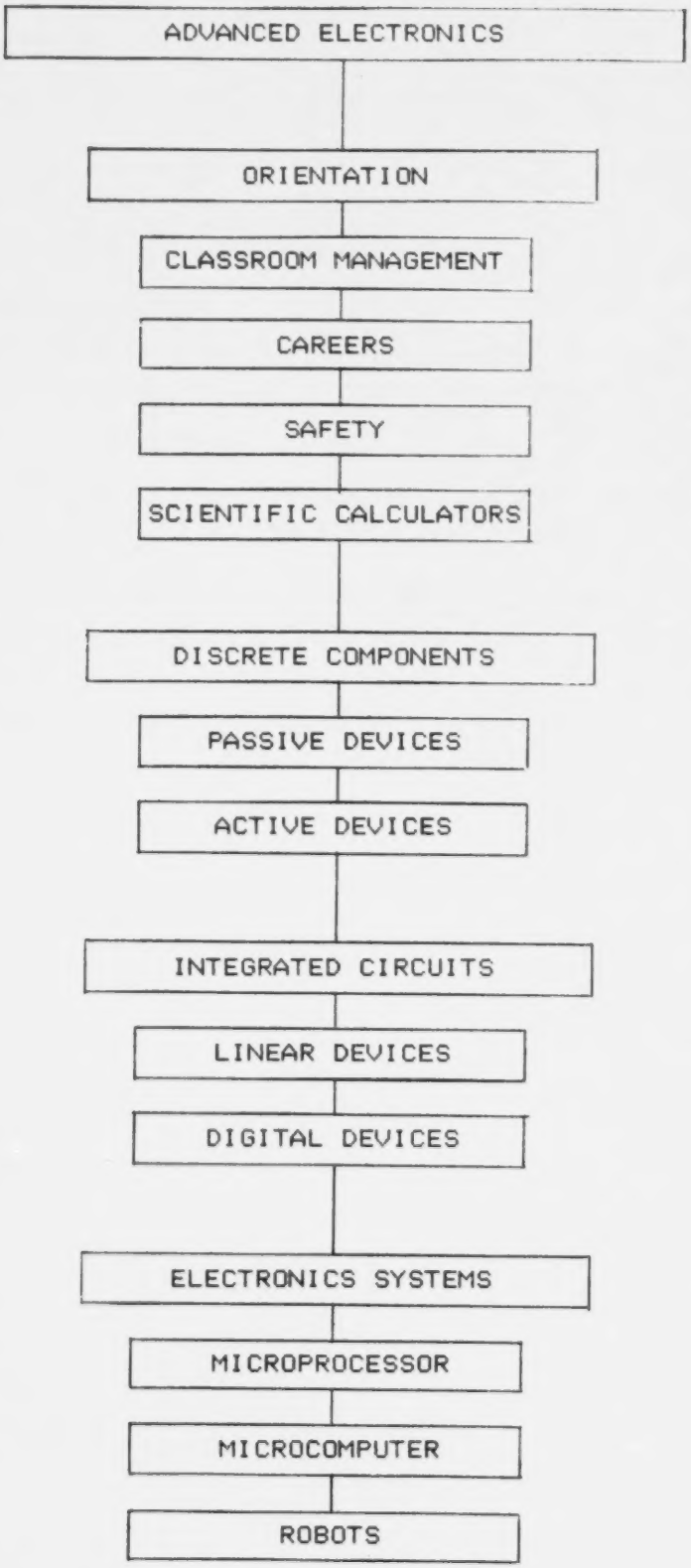
ADVANCED ELECTRONICS
ORIENTATION
CLASSROOM MANAGEMENT
CAREERS
SAFETY
SCIENTIFIC CALCULATORS
DISCRETE COMPONENTS
PASSIVE DEVICES
ACTIVE DEVICES
INTEGRATED CIRCUITS
LINEAR DEVICES
DIGITAL DEVICES
ELECTRONICS SYSTEMS
MICROPROCESSOR
MICROCOMPUTER
ROBOTS

Title:

Advanced Electronics

Course Description:

Advanced Electronics is intended for those students who successfully complete Basic Electronics with a grade of C or better and desire to continue their training in this field. It is hoped these students have career interests in this area. The course content centers around semiconductor devices and their applications to digital electronics, computer, and communication circuits. Emphasis is placed on technology and its applications rather than on specific skills.

Target Grade Level:

This course is designed for students in grades 11 and 12.

Prerequisites:

Basic Electronics (Trigonometry desirable).

Course Goal:

In Advanced Electronics, the students will build upon their previous experiences in Basic Electricity/Electronics. They will go more in-depth in the field of electronics. Students will also be aware of the occupational and educational opportunities available upon completion of this course.

Course Objectives:

1. To develop a working knowledge of electronics.
2. To provide students with opportunities to explore those aspects of electronics that best meet their needs, aptitudes, or interests.
3. To provide students opportunities to apply science and math skills to practical situations.
4. To develop basic skills in the proper use of tools and equipment.
5. To develop problem-solving abilities and critical thinking.
6. To develop safety-conscious attitudes and safe work habits.
7. To provide students the opportunities to explore occupational and educational opportunities in electronics and related fields.

8. To develop an awareness of the diverse nature of the field of electronics and its impact on society.

9. To develop ability to use test instruments properly.

10. To develop ability to recognize electronic components.

11. To develop a useful vocabulary of electronic terms.

12. To develop a knowledge of the working principles of semiconductor components.

13. To inform students so that they may become wise consumers of electronic goods.

Introduction:

In this age of electronics, a substantial knowledge of the subject is necessary for students entering technical fields. As technology progressed from vacuum tubes to MOSFETs, the entire industry had to change. As the size of components decreased to integrated circuits, digital electronics evolved. As a result of the demand for products using digital electronics, electronic companies have a critical need for technicians who can build, analyze, test, and troubleshoot complex circuits.

Digital electronics and the computer field have benefited the most by the advances in semiconductor technology. Computers are now found in the home, school, business, industry, automobiles, weapons systems, hospitals, and in many other applications.

This course goes in-depth in many of the areas of electronics, giving the student a sound base from which to advance to other areas. It is as technologically up-to-date as possible. As new information is discovered, the instructor should make necessary changes to keep subject matter as relevant as possible.

In order to successfully implement this program, it is imperative that the training systems on the equipment list be purchased.

TIME FRAME

Unit I-A	Classroom Management	2 Hours
Unit 1-B	Careers	3 Hours
Unit 1-C	Safety	5 Hours
Unit 1-D	Scientific Calculations	5 Hours
Unit II-A	Discrete Components--Passive Devices	15 Hours
Unit II-B	Discrete Components--Active Devices	30 Hours
Unit II-C	Discrete Components--Subsystems	30 Hours
Unit III-A	Integrated Circuits--Linear Devices	30 Hours
Unit III-B	Integrated Circuits--Digital Devices	30 Hours
Unit IV-A	Microprocessors	10 Hours
Unit IV-B	Microcomputers	10 Hours
Unit IV-C	Robotics	10 Hours

Total - 180 Hours

Time has been allowed for project construction within Units II-C, IIIA, and IV. Consideration should be given to entering these projects in the Regional Student Fair.

COURSE OUTLINE

First Semester

I. Orientation

A. Classroom Management

B. Careers

C. Safety

1. Personal safety practices
2. Safety hazards
3. Color codes
4. Mechanical safety
5. Emergency procedures (First Aid)

D. Scientific Calculators

II. Discrete Components

A. Passive Devices

1. Characteristics
   a. Components
   b. D.C. circuits
      (1) Ohm's law
      (2) Watt's law
      (3) Kirchoff's law
   c. A. C. circuits
      (1) Transformers
      (2) RC and RL
      (3) Resonant
2. Applications
   a. Test equipment
   b. Filters
   c. Voltage divider networks
   d. Bridge circuits

B. Active Devices

1. Semiconductor materials
2. Diodes
3. BJT
4. FET
   a. JFET
   b. MOSFET
5. Thyristors
   a. SCR
   b. Triac
   c. Diac
   d. Unijunction

C. Subsystems

1. Power supply
2. Amplifiers
3. Oscillators
4. Receivers
5. Transmitters

COURSE OUTLINE

Second Semester

III. Integrated Circuits

A. Linear Devices

1. Characteristics
   a. Advantages and disadvantages of IC's
   b. Operational amplifier
2. Applications
   a. Communications
      (1) Audio amplifiers
      (2) AM radio system
   b. Industrial circuits
      (1) Temperature controls
      (2) Optical circuits

B. Digital Devices

1. Binary concepts
2. Combination logic
   a. AND, OR, and inverters
   b. NOR and NAND
   c. Exclusive OR
3. Sequential logic
   a. Multivibrators
      (1) Astable
      (2) Bistable
      (3) Monostable
   b. Counters
      (1) Asynchronous
      (2) Synchronous
4. Codes
   a. BCD
   b. Octal
   c. Hexadecimal
5. Analog conversions
6. Memory devices

IV. Electronic Systems

A. Microprocessors

1. Block diagrams of computer
2. Microcomputer vs. microprocessor
3. Register
4. Machine language

B. Microcomputer

1. Input/out devices
2. Storage devices

C. Robotics

1. Operation of the robot system
2. Control of the robot system

UNIT I-A: CLASSROOM MANAGEMENT 2 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: state the procedures governing absences, tardies, lab fees, equipment/supply/project storage areas, restroom privileges, grades, and any other items discussed.	A. Classroom Management	Participate in discussion on classroom management.	Discussion covering school and class policies.	Local School Handbook

UNIT I-B: CAREERS 3 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: name several occupations related to electronics and state sources of information on these occupations.	B. Careers 1. Engineer 2. Electrical and electronic technician 3. Electrician 4. Computer programmer and operator 5. Teacher 6. Service technician 7. Computer systems analysts 8. Sales representatives 9. Stock clerks, stockroom and warehouse 10. Supervisors	Discuss related careers. Use classified ads from newspaper to make poster on electronics careers. Use resource material in school library to make oral and written reports on electronics careers.	Provide career information films. Have an engineer and electrician speak to class. Provide appropriate amount of time for research.	Book 14, pp. 1A-20A Book 6, pp. 333-337

UNIT 1-C: SAFETY 5 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	C. Safety	Take notes.	Show film and filmstrips.	Book 14, pp. 21A-64A
develop responsible behavioral attitudes required for electronics.	1. Personal safety a. State safety laws b. OSHA	Explain electric shock and ways of prevention.	Discuss safety procedures.	
identify personal safety practices.	c. Electrical shock d. Current and its effect on the human body	Discuss current and its effect on the human body at 120 volts, 60 hertz (cycles).	List laws on chalk board. Chart of current and its effects on the human body.	Book 18, p. 4
list personal protective devices.	e. Protection (1) Body (all parts) (2) Clothes (3) Jewelry			Book 18, pp. 27-36
explain importance of good housekeeping.	f. Housekeeping	Organize a clean up roster for housekeeping.	Make chart and explain duties.	Book 18, pp. 37-43
understand electrical safety hazards and prevention measures.	2. Safety Hazards a. Hazardous conditions (1) Wet area (2) Defective equipment (3) Reporting procedure	Discuss electrical hazards.		
list examples of common unsafe acts that result in electrical accidents or injuries.	b. Ground fault (1) Electrical tool (2) Safety device	List preventions for electrical hazards.	Discuss grounding. Lead group discussion on live circuits and chemicals.	
	c. Live circuits	Explain grounding tools and devices. Discuss the proper procedure for working around live circuits.		

UNIT 1-C: SAFETY (Continued)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
identify appropriate types of fire extinguishers. list the location of fire alarms and explain the proper procedure to evacuate the lab/classroom in case of fire.	d. Fire safety (1) Fire extinguishers (a) Types (b) Use (c) Maintenance (2) Class of fires (a) Class A (b) Class B (c) Class C (d) Class D	Practice evacuation of lab/classroom in case of fire. Match the fire with the proper extinguisher.	Hold classroom fire drills and discuss class of fires.	Book 18, pp. 54-62
	e. Chemicals (1) Group A atmosphere (2) Group B atmosphere (3) Group C atmosphere (4) Group D atmosphere	Name some unsafe chemicals from each group.		
identify each color code.	3. Color codes a. Red b. Yellow c. Green d. Orange e. Purple	Define and discuss tools, machines, equipment, and apparatus with color code section.	Explain where each color of the color code will be found.	Book 18, pp. A1-A2
identify safety factors for all electrical tools. list the most common unsafe acts.	4. Mechanical safety a. Hand tools (1) Appropriate tools for the job (2) Good condition b. Power tools (1) All power tools should be grounded (2) Excessive pressure should never be used with portable electric tools	List electrical/hand/power tools in notebook with safety rules.	Demonstration of safe and correct use.	

UNIT 1-C: SAFETY (Continued)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	(3) Extension cord (a) Plugging (b) Disconnecting			
identify the types of electrical meters and their safety rules.	c. Meters (1) Ammeter (2) Voltmeter (3) Multimeter (4) Wattmeter (5) Digital multimeter	Perform lab activities with meters. Safety do's and don'ts. Proper way to test equipment. Observe polarity in dc circuit. Selecting the dc ranges.	Identify the proper connection polarity and ranges. Show film.	Book 18, pp. 25-36
list the common unsafe acts of ladder use.	d. Ladder use (1) Step ladders (2) Extension	Discuss ladder and safety.	Discuss parts and safe use.	
understand the responsibility of emergency procedures.	5. Emergency procedures (First Aid)	Discuss emergency procedures and some general first aid.	Identify bleeding, breaks, wounds, and electrical shock.	Book 18, pp. 47-54
identify when to act and how to act.	a. Bleeding (1) Blood spurts (2) Blood flows (3) Blood oozes b. Breaks or fractures (1) Simple fractures (2) Compound fractures d. Electrical shock (1) Shut off the current quickly (2) Remove the victim (3) Check heart and lungs (4) Apply artificial respiration			Book 18, pp. A26-A44

UNIT I-C: SAFETY (Continued)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
identify equipment failure and take appropriate precautionary action.	e. Equipment failure (1) Wrong size or type (2) Overloading (3) Test equipment (4) Extension cords	List unsafe electrical conditions that could lead to equipment failure. Work study sheet Take unit test on safety.	Discuss unsafe electrical conditions stated by student.	Book 18, pp. S52-S59

UNIT I-D: SCIENTITIC CALCULATIONS 5 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: perform arithmetical functions on scientific calculators scoring a minimum of 70 percent on unit test. calculate trigonometric equations. express numbers in scientific notation and change numbers expressed in scientific notation as decimal number. calculate logarithms and reciprocals.	D. Scientific Calculators 1. Data keys a. Arithmetic b. Exponent 2. Function keys a. Trigonometry b. Log c. Memory	Obtain a scientific calculator. Complete arithmetic function worksheets. Complete powers and roots worksheets. Complete trigonometric function worksheet. Complete logarithm and reciprocal worksheet. Take test on calculations.	Demonstrate use of data keys. Demonstrate use of function keys. Review for test.	Book 14, pp. BSC-130C

UNIT II-A: DISCRETE COMPONENTS--PASSIVE DEVICES 15 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	A. Passive Devices	Identify electronic components and draw their symbols.	Review use of ohmmeter. Discuss role of electronic components in circuits.	Book 6, pp. 38-44 Book 14, pp. 131C-166C Book 14, pp. 145D-178D
name the electronic passive devices and the roll they play in electronic circuits.	1. Characteristics a. Components (1) Resistors (2) Capacitors (3) Inductors (4) Relays	Perform lab activities using passive devices.	Hand out activity worksheets.	Book 6, pp. 128-143 Book 6, pp. 106-127 Book 14, pp. 69D-104D
recognize common electronic parts by their physical appearances.				
learn how to find sources for electronic parts.				
tell the function of a resistor and how to read resistor color codes.				
draw a correct electronic schematic diagram.		Draw a schematic diagram and identify all componets.	Demonstrate correct methods for drawing electronic schematics.	
		Take test on components and symbols.	Review use of ammeter and voltmeter.	
state Ohm's law.	b. D.C. circuits (1) Ohm's law (2) Watt's law (3) Kirchoff's law	Complete worksheets on Ohm's, Watt's and Kirchoff's laws.	Review mathematical equations dealing with Ohm's, Watt's, and Kirchoff's laws.	Book [illegible]
solve problems for unknown voltage, current, and resistance.				
use Ohm's law with circuit measurements.				
compute current using the power formula.				

UNIT II-A: DISCRETE COMPONENTS--PASSIVE DEVICES (Continued)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
determine the power used in a resistive circuit. determine the function of fuses and resistor power ratings.				
measure and calculate quantities in series-parallel circuits. construct a voltage divider.		Complete a lab activity which demonstrates ability to work with series-parallel circuits. DC circuits test.		Book 14, pp. 293C-322C Book 10, pp. 69-72 Book 14, pp. 417C-474C
use turns-ratios to analyze transformer circuits. explain the basic operating principles of the transformer.	c. A.C. circuits (1) Transformers	Solve problems dealing with transformer turns-ratios.	Show transformers and discuss transformer turns-ratios formulas.	Book 2, pp. 293-309 Book 6, pp. 106-145 Book 14, pp. 234D-285D
define and calculate capacitive reactance. define and calculate inductive reactance.	(2) RC and RL		Discuss impedance and how to determine it in RL and RC circuits.	
solve problems of reactance, impedance, and parameters of resonant circuits, and demonstrate the ability to determine resonance in a series RCL circuit.	(3) Resonant	Complete a lab activity which demonstrates understanding of impedance and phase angle. Demonstrate ability to determine resonance in a RCL circuit.	Demonstrate methods for determining resonance mathematically and with test equipment.	

UNIT II-A: DISCRETE COMPONENTS--PASSIVE DEVICES (Continued)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Read, calibrate, and measure electrical quantities using the analog or digital VOM and oscilloscope.	2. **Applications** a. Test equipment (1) Meters (2) Power supply (3) Oscilloscopes (4) Generators	Identify, select, and handle a variety of electronics test equipment.	Utilize appropriate test equipment and review correct operating procedure of each.	Book 10, pp. 152-194 Book 2, pp. 633-675 Book 6, pp. 93-105
	b. Filters c. Voltage divider networks d. Bridge circuits	Construct and analyze a circuit containing passive devices. Take unit test on passive devices.		Book 6, pp. 183-187 Book 17, pp. 67-88 Book 2, pp. 135-137

UNIT II-B: DISCRETE COMPONENTS--ACTIVE DEVICES 30 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	B. Active Devices	Complete worksheets on N and P type material.	Use periodic chart to discuss germanium and silicon with doping.	Book 17, pp. 1-34 Book 15, pp. 6-13
tell basic structure of semiconductor materials.	1. Semiconductor materials a. N type b. P type			
determine the effects of forward and reverse bias on current flowing through a semiconductor diode.	2. Diodes a. PN junction b. Biasing c. Ratings d. Types	Perform the lab activities that: (a) test diodes (b) plot diode characteristics Take notes.	Use ohmmeter to check diode. Discuss different types of diodes, such as zener, tunel, varicaps, LED, and photo.	Book 17, pp. 35-66 Book 15, pp. 14-29 Book 6, pp. 173-178
use an ohmmeter to measure the front to back resistance ratios of commonly used diodes.				
use symbols and terminology pertaining to transistors.	3. BJT's a. PNP b. NPN c. Biasing d. Interpreting data sheets	Perform the following lab activities that: (a) identify transistor leads, (b) test transistors for "opens" and "shorts," (c) test for NPN and PNP, and (d) bias transistors Take test on diodes and transistors.	Demonstrate use of ohmmeter and transistor tester to check transistor.	Book 17, pp. 113-142 Book 15, pp. 55-77 Book 6, pp. 194-209
read listings of transistor operating parameters; interpret and apply the information to actual circuits.				
explain the construction and basic operating theory of the following active devices: Bipolar junction Transistor Junction field effect Transistor	4. FET's a. JFET (1) N channel (2) P channel (3) Biasing (4) Interpreting data sheets	Perform the following lab activities that (a) identify FET characteristics (b) test common-source amplifier (c) test source-follower amplifier Take notes.	Discuss the different types of FET's and Thyristors.	Book 15, pp. 101-106 Book 17, pp. 335-370 Book 2, pp. 429-441 Book 2, pp. 442-445 Book 15, pp. 70-75
Metallioxide Semiconductor FET	b. MOSFET (1) N channel (2) P channel (3) Biasing (4) Interpreting data sheets	Perform the following lab activities that: (a) identify MOSFET characteristics (b) test MOSFET amplifier		

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UNIT II-B: DISCRETE COMPONENTS--ACTIVE DEVICES (Continued)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Thyristor **Explain the operation and uses of the silicon controlled rectifier.** **Explain the theories and uses of the unijunction transistor.**	5. Thyristors a. SCR b. Triac c. Diac d. Unijunction	Perform the following lab activities that: (a) identify characteristics of thyristors (b) test trigger circuits for thyristors Perform a lab activity that tests the use of the UJT relaxation oscillator. Take test on symbols for active devices. Take test on active devices.	Use semiconductor tester to check the following: JFET, MOSFET, SCR, TRIAC, DIAC, and UJT.	Book 17, pp. 335-370 Book 2, pp. 514-520 Book 15, pp. 240-257

UNIT II-C: DISCRETE COMPONENTS--SUBSYSTEMS 30 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	C. Subsystems	Take notes	Discuss four main classes: Converter Inverter Transformers Rectifiers	Book 6, pp. 178-193 Book 17, pp. 35-88 Book 15, pp. 30-54
list the common filter circuits. compare the output characteristics such as ripple and output voltages for different filter circuits.	1. Power supply a. Transformer action b. Rectification c. Filtering d. Voltage divider e. Voltage regulation	Lab activities: Half-wave rectifier Full-wave rectifier Bridge rectifier Filtering Test on Power supplies	Construct power supplies and show waveforms on oscilloscope.	
build from a schematic a basic amplifier circuit and test circuit parameters. tell the characteristics of the three transistor configurations. tell the operating characteristics of the transistor power amplifier.	2. Amplifiers a. Circuit types (1) CE (2) CB (3) CC b. Signal amplifier c. Power amplifier	Take notes Lab activities: Transistor current control Biasing CE, CB, and CC Power dissipation in a transistor Test on amplifiers	Handout showing gain and impedance characteristics of basic transistor amplifier types (CE, CB, CC).	Book 17, pp. 183-230 Book 15, pp. 78-96 Book 6, pp. 210-227 Book 15, pp. 97-114 Book 15, pp. 155-135
	3. Oscillators a. Armstrong b. Hartley c. Colpitts d. RC e. Crystal f. Tuned	Lab activities: Construct Armstrong oscillator Construct Hartley oscillator Construct Colpitts oscillator Test on oscillators	Discuss theory of operation of oscillators.	Book 17, pp. 371-388 Book 15, pp. 174-195 Book 6, pp. 250-266
tell the characteristics of the AM and FM receiver.	4. Receivers	Take notes from discussion, complete worksheet block diagram of AM, FM, and TV receiver.	Discuss block diagrams of receivers.	Book 17, pp. 415-436 Book 15, pp. 196-215 Book 6, pp. 267-293
tell the theory and principles of the AM transmitter.	5. Transmitters a. CB b. Broadcasting	Draw and label block diagrams of CB and broadcasting transmitters. Test on receivers and transmitters.	Show schematics of receivers. Display chassis of AM and FM radio and TV.	Book 17, pp. 389-414 Book 2, pp. 448-470

UNIT III-A: INTEGRATED CIRCUITS--LINEAR DEVICES 30 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	A. Linear Devices 1. Characteristics a. Advantages and disadvantages of IC's		Discuss advantages and disadvantages of integrated circuits. Look at the IC's chip under microscope.	Book 15, pp. 216-237
explain the basic operating principles and uses of the operational amplifier. explain summing circuits. explain differential circuits.	b. Operational amplifier (1) Inverting (2) Noninverting (3) Summing (4) Differentiating	Lab activities: Construct and test inverting and noninverting amplifier. Construct and test summing and differentiating amplifier. Test on operational amplifier	Show internal schematics of 741 Operational Amplifier IC.	Book 17, pp. 231-270 Book 15, pp. 136-155 Book 2, pp. 471-487
explain the applications of operational amplifier.	c. Voltage regulators d. Voltage referencers e. Instrumentation amplifiers f. Sample and holding circuits	Lab activities on VR's. Power supply using IC voltage regulators. Measuring temperature change with Op amp	Show examples of different voltage regulator chips, fixed, and adjustable.	Book 15, pp. 264-290
list various applications of IC's in communication circuits.	2. Applications a. Communications (1) Audio amplifiers (2) AM radio system (3) Phase-locked loop (4) TV circuits	Construct audio amplifier with IC's used in communication.	Show chassis of radio and TV with IC's.	Book 15, pp. 223-230
discuss use of IC's in industrial circuits, cars, homes, and business.	b. Industrial circuits (1) Temperature controls (2) Optical circuits (3) Tone decoders	Test on applications of linear devices.		Book 15, p. 250 Book 17, pp. 89-112

UNIT III-B: INTEGRATED CIRCUITS--DIGITAL DEVICES 30 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	B. Digital Devices		Show examples of digital systems.	Book 16, pp. 1-13 Book 5, pp. 1-5
explain how Off and On equals O's and 1's.	1. Binary concepts	Lab activities: build and test AND or OR gates build and test NOR and NAND gates		
explain the operation of AND, OR, and NOR Gates and Truth Tables.	2. Combination logic circuitry a. AND, OR, and inverters b. NOR and NAND c. Exclusive OR d. Adders e. Schmitt trigger	use exclusive OR build adder Test on logic circuits	Use digital trainer to demonstrate combinational logic circuitry operation.	Book 16, pp. 21-39 Book 5, pp. 45-85 Book 16, pp. 126-150 Book 5, p. 40
explain functions of combination logic circuitry.				
apply the principles of clocking circuits to digital electronics.	3. Sequential logic circuitry a. Multivibrators (1) Astable (2) Bistable (3) Monostable	Construct clocks and timers.	Use digital trainer to demonstrate sequential logic circuitry.	Book 16, pp. 80-94 Book 1, pp. 227-254 Book 5, pp. 141-184
explain functions of sequential logic circuitry.				
explain operation of various counter circuits.	b. Counters (1) Asynchronous (2) Synchronous (3) Decade	Construct: BCD decade counter Sequence generator Seven-segment decoder		Book 16, pp. 95-112 Book 1, pp. 279-311 Book 5, pp. 185-224
convert decimal numbering system to binary numbering.	4. Codes a. Binary b. BCD c. Octal	Worksheets using different codes Test on codes	Show filmstrips on codes.	Book 16, pp. 64-79 Book 5, pp. 4-18 Book 1, pp. 19-29
convert binary numbers into other common codes: BCD, OCTAL, and HEX				

UNIT III-B INTEGRATED CIRCUITS --DIGITAL (Continued)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Explain the need for analog conversion circuitry.	5. Analog conversions a. D to A b. A to D	Lab activities: D to A conversion A to D conversion		Book 16, pp. 206-233 Book 5, pp. 257-292
compare and explain difference in the D/A and A/D converter.				
compare memory storage in terms of access time and capacity.	6. Memory devices a. Magnetic (1) Core (2) Bubble		Display examples of memory devices.	Book 16, pp. 160-189 Book 5, pp. 327-360
describe the differences between the following devices: RAM, ROM, PROM, and EPROM.	b. Semiconductor (1) RAM (2) ROM (3) PROM	Lab activities: Latches RS flip-Flops D-type and T-type flip-flops Test on digital devices		Book 16, pp. 154-159 Book 5, pp. 293-326 Book 1, pp. 358-367

UNIT IV-A: MICROPROCESSORS 10 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	A. Microprocessors	Write a report on how microprocessors are used in the home, office, and industry.	Show block diagrams of computer.	Book 9, pp. 34-60
name functional blocks of a microprocessor and describe their purposes.	1. Block diagrams of computer		Use computer to show different blocks	
compare a microcomputer to a microprocessor.	2. Microcomputer vs. Microprocessor	Draw pin-out diagram for IC's used to control the microprocessor.	Compare microcomputer and microprocessor in discussion.	Book 5, pp. 361-396
	3. Designing a basic computer system		Discuss and compare different microprocessors that are available.	Book 16, pp. 177-181
	4. Microprocessor clock		Compare basic RC clocks and microprocessor clocks	
	5. Address, data, and control bus	Complete lab worksheets with microprocessor trainer.	Draw block diagram of microprocessor and show address bus, data bus, and control bus.	Book 3, pp. 29-16
	6. Computer memory		Discuss computer memory including ROM, PROM, EPROM, and RAM.	
	7. Register		Discuss different types of register circuits.	
	8. Machine language		Write program to add two numbers using machine language.	
		Test on microprocessors		

UNIT IV-B: MICROCOMPUTERS 10 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	B. Microcomputer	Use logic probe to observe signal flow through computer.	Demonstrate how test equipment and logic diagrams can be used to troubleshoot a computer system.	Book 16, pp. 170-178
name functional blocks of a computer system; tell the purpose of each and describe types of each.	1. Control unit			
compare CRT and printer display system.	2. Input-out devices a. CRT b. LCD c. DOT matrix d. Daisy wheel	Draw a block diagram of a printer and label major components. Service a printer.	Discuss functional parts and operation of input and output devices.	Book 5, pp. 341-354
compare auxiliary storage device, floppy, and hard disk system.	3. Storage devices a. Hard b. Floppy	Draw block diagram of a disk drive and label major components. Service a disk drive.	Discuss functional parts and operation of auxiliary storage devices.	Book 16, pp. 165-167 Book 13, pp. 414-440
write simple machine language program.	4. Machine language	Write a machine language program. Complete lab worksheets with microcomputer trainer. Test on microcomputer	Discuss machine language programming.	Book 13, pp. 465-483 Book 13, pp. 541-544

UNIT IV-C: ROBOTICS 10 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	C. Robotics		Discuss why robots are being implemented in industry.	Book 12, pp. 11-43
explain uses of robots in industry and tell why they are found in industry today.				
use correct terminology to describe major components of robot system.	1. Operation of the robot system a. Uses b. Components c. Terminology	Draw a block diagram of robotics system and label parts.	Demonstrate a robot, explaining major components.	Book 7, pp. 27-30 Book 4, pp. 63-83
explain how the robot's motion is controlled.	2. Control of the robot system a. Sensors b. Servo motors	Make adjustments on robot's motion sensors.	Discuss motion sensors and servo motors.	Book 9, pp. 63-86 Book 9, pp. 114-148 Book 12, pp. 121-139
program the robot to perform specific tasks.	c. Programming of the robot system (1) Teach pendant (2) Interfacing (3) Programming	Use a teach pendant to complete a task. Write a computer program for the robot to complete a task.	Demonstrate programming of robot to perform a specific job.	Book 7, pp. 109-125 Book 7, pp. 296-320 Book 7, pp. 260-280
		Take a field trip to local industry to see robots in use.	Demonstrate how to troubleshoot robotics system.	
		Complete lab worksheets with robotics trainer.		
		Test on robotics		

EQUIPMENT LIST

The purpose of this section is to provide the teacher with an equipment list to set up the laboratory. First each student station will be listed; then equipment used jointly by all stations will be listed.

One each per student station (two students per station).

Instrumentation and power

1. Digital multimeter
2. Digital AC/DC power supply
3. Regulated AC/DC low voltage power supply
4. Dual trace oscilloscope (50 MHZ)
5. Function generator
6. Universal counter/timer

Training system

1. DC/AC electricity trainer
2. Semiconductor and communications trainer
3. Digital trainer
4. Microcomputer trainer

Hand tools and supplies

1. Wire strippers
2. Needle-nose pliers
3. Wire cutters
4. Soldering iron and holder
5. Screwdrivers (2)
6. Goggles (2)
7. Breadboards
8. Logic probe

Equipment for Laboratory (one of each)

1. Robotic trainer
2. Computer (with disk drive, printer, and monitor)
3. Drill press
4. Vise
5. Index drill set
6. Set of nut drivers
7. Wire
8. Solder
9. Fuses
10. Pilot lights
11. Printed circuit board supplies
12. Adjustable wrench
13. Signal tracer
14. Transistor tester
15. Desolder tools
16. Files

BIBLIOGRAPHY

1. Boyce, Jefferson C. Digital Logic Operation and Analysis. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1982.

2. De Guilmo, Joseph M. Electricity/Electronics Principles and Applications. Albany, NY: Delmar, 1982.

3. De Guilmore, Charles M. Introduction to Microprocessors. New York: McGraw-Hill, 1981.

4. Dork, Richard C. Robotics and Automated Manufacturing. Reston, VA: Reston Publishing Co.,Inc., 1983.

5. Forbes, Mark and Brey, Barry B. Digital Electronics. Indianapolis: Bobbs-Merrill Educational Publishing, 1984.

6. Gerrish, Howard H. and Dugger, William. Transistor Electronics. South Holland, IL: Goodheart-Wilcox, 1981.

7. Heath, Larry. Fundamentals of Robotics. Reston, VA: Reston Publishing Co., 1985.

8. Heiserman, David L. Microprocessor Instruction Sets and Software Principles. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1983.

9. Kafrissen, Edward and Stephans, Mark. Industrial Robots and Robotics. Reston, VA: Reston Publishing Co., Inc., 1984.

10. Loper, Ahr, et al. Electricity and Electronics. Albany, NY: Delmar, 1979.

11. Malvino, Albert Paul. Digital Computer Electronics. New York: McGraw-Hill, 1983.

12. Masterson, Poe, et al. Robotics. Reston, VA: Reston Publishing Co., Inc., 1985.

13. O'Conner, Patrick. Digital and Microprocessor Technology. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1983.

14. Robertson, L. Paul. Basic Electronics I. Stillwater, OK: MAVCC., 1980.

15. Schuler, Charles A. Electronics Principles and Applications. New York: McGraw-Hill, 1984.

16. Tokheim, Roger L. Digital Electronics and Applications. New York: McGraw-Hill, 1984.

17. Willison, Neal A. and Shelton, James K. Basic Electronics II. Stillwater, OK: MAVCC, 1981.

18. Louisiana State Department of Education. General Safety Manual for Vocational Education and Industrial Arts Programs. Bulletin 1674. Baton Rouge, LA, 1982.